Claims

The invention in which an exclusive property or privilege is claimed is defined as follows:

1. An apparatus for shaping part of the collective output beam of a plurality of semiconductor lasers, the plurality of semiconductor lasers being arranged to define a plurality of light-emitting areas and a plurality of non-light-emitting areas, and the semiconductor lasers having dimensions in X, Y and Z axes, wherein the Y axis defines a fast axis, the X axis defines a slow axis, and the Z axis defines an axis of propagation for the output beam, the apparatus comprising:

a first reflective member comprising at least a first reflective element positioned a fixed distance from the semiconductor lasers, the at least first reflective element adapted to deflect a first portion of the output beam in a first direction oriented at a first angle in the slow axis direction and at a second angle in the fast axis direction;

at least a second reflective member comprising at least a first reflective element positioned a fixed distance from the semiconductor lasers, the at least first reflective element of the second reflective member adapted to deflect the first portion of the output beam from the first direction to a second direction in the Z axis direction; and

whereby the first portion of the output beam is oriented approximately parallel to the un-deflected remainder of the output beam, and the non-light-emitting areas are substantially eliminated from the output beam.

2. The apparatus of claim 1, wherein:

the first reflective member further comprises a second reflective element positioned a fixed distance from the semiconductor lasers, the second reflective element adapted to deflect a second portion of the output beam in a third direction oriented at a third angle in the slow axis direction and at a fourth angle in the fast axis direction;

the at least second reflective member comprising a second reflective element positioned a fixed distance from the semiconductor lasers, the at least second reflective element of the second reflective member adapted to deflect the second portion of the output beam from the third direction to a fourth direction in the Z axis direction; and

whereby the first and second portions of the output beam are oriented approximately parallel to each other and to the un-deflected remainder of the output beam, and the non-light-emitting areas are substantially eliminated from the output beam.

3. The apparatus of claim 2, wherein the third direction is approximately opposite the first direction, the first and third angles are approximately the same, the second and fourth angles are approximately the same, and the second and fourth directions are approximately the same.

4. The apparatus of claim 2, further comprising at least one optical member adapted to balance the optical path length of the un-deflected remainder of the output beam, the at least one optical member being disposed at a fixed position on the axis of propagation of the un-deflected remainder of the output beam.

5. The apparatus of claim 1, further comprising:

the first reflective element further adapted to deflect a second portion of the output beam in a third direction oriented at a third angle in the slow axis direction and at a fourth angle in the fast axis direction;

the at least second reflective member comprising a second reflective element positioned a fixed distance from the semiconductor lasers, the at least second reflective element of the second reflective member adapted to deflect the second portion of the output beam from the third direction to a fourth direction in the Z axis direction; and

whereby the first and second portions of the output beam are oriented approximately parallel to each other and to the un-deflected remainder of the output beam, and the non-light-emitting areas are substantially eliminated from the output beam.

6. The apparatus of claim 5, wherein the third direction is approximately opposite the first direction, the first and third angles are approximately the same, the second and fourth angles are approximately the same, and the second and fourth directions are approximately the same.

7. The apparatus of claim 5, further comprising at least one optical member adapted to balance the optical path length of the un-deflected remainder of the output beam, the at least one optical member being disposed at a fixed position in the axis of propagation of the un-deflected remainder of the output beam.

8. An apparatus for shaping part of the collective output beam of a plurality of semiconductor lasers comprising individual bars of semiconductor lasers stacked one on top of the other to form an array, the plurality of semiconductor lasers being arranged to define a plurality of light-emitting areas and a plurality of non-light-emitting areas, and the array having dimensions in X, Y and Z axes, wherein the Y axis defines a fast axis, the X axis defines a slow axis, and the Z axis defines an axis of propagation for the output beam, the apparatus comprising:

a first reflective member comprising at least a first reflective element positioned a fixed distance from each bar in the array, the at least first reflective element adapted to deflect a first portion of the output beam from each bar in the array in a first direction oriented at a first angle in the slow axis direction and at a second angle in the fast axis direction;

at least a second reflective member comprising at least a first reflective element positioned a fixed distance from each bar in the array, the at least first reflective element of the second reflective member adapted to deflect the first portion of the output beam from each bar from the first direction to a second direction oriented in the Z axis direction; and

whereby the first portion of the output beams of each bar in the array are oriented approximately parallel to the un-deflected remainder of the output beams of each bar, and the non-light-emitting areas are substantially eliminated from the output beams.

9. The apparatus of claim 8, wherein:

the first reflective member further comprises a second reflective element positioned a fixed distance from each bar in the array, the second reflective element

adapted to deflect a second portion of the output beam from each bar in a third direction oriented at a third angle in the slow axis direction and at a fourth angle in the fast axis direction;

the at least second reflective member comprising a second reflective element positioned a fixed distance from each bar in the array, the at least second reflective element of the second reflective member adapted to deflect the second portion of the output beam of each bar from the third direction to a fourth direction in the Z axis direction; and

whereby the first portion and second portion of the output beams of each bar in the array are oriented approximately parallel to the un-deflected remainder of the output beams of each bar, and the non-light-emitting areas are substantially eliminated from the output beams.

10. The apparatus of claim 9, wherein the third direction is approximately opposite the first direction, the first and third angles are approximately the same, the second and fourth angles are approximately the same, and the second and fourth directions are approximately the same.

11. The apparatus of claim 9, further comprising at least one optical member adapted to balance the optical path length of the un-deflected remainder of the output beam of at least one of the bars in the array, the at least one optical member being disposed at a fixed position in the axis of propagation of the un-deflected remainder of the output beam.

12. The apparatus of claim 8, further comprising:

the at least first reflective element further adapted to deflect a second portion of the output beam of each bar in a third direction oriented at a third angle in the slow axis direction and at a fourth angle in the fast axis direction;

the at least second reflective member comprising a second reflective element positioned a fixed distance from each bar in the array, the at least second reflective element of the second reflective member adapted to deflect the second portion of the output beam from the third direction to a fourth direction in the Z axis direction; and

whereby the first portion and second portion of the output beams of each bar in the array are oriented approximately parallel to the un-deflected remainder of the output beams of each bar, and the non-light-emitting areas are substantially eliminated from the output beams.

13. The apparatus of claim 12, wherein the third direction is approximately opposite the first direction, the first and third angles are approximately the same, the second and fourth angles are approximately the same, and the second and fourth directions are approximately the same.

14. The apparatus of claim 12, further comprising at least one optical member adapted to balance the optical path length of the un-deflected remainder of the output beam of at least one bar in the array, the at least one optical member being disposed at a fixed position in the axis of propagation of the un-deflected remainder of the output beam.

15. The apparatus of claim 8, wherein the total height of the first and second

reflective members corresponds to the pitch of the semiconductor lasers in the array.

16. The apparatus of claim 8, wherein the output beams of each bar in the array are propagated in a direction substantially perpendicular to a plane defined by the X and Y axes.

17. The apparatus of claim 12, wherein the total height of the first and second reflective members corresponds to the pitch of the semiconductor lasers in the array.

18. The apparatus of claim 12, wherein the output beams of each bar in the array are propagated in a direction substantially perpendicular to a plane defined by the X and Y axes.

19. The apparatus of either claim 8 or claim 12, wherein the at least first element of the second reflective member comprises a monolithic element having a plurality of individual reflective portions each adapted to reflect a portion of the output beam of a discrete one of the bars in the array, and a plurality of cut-out portions defined between adjacent reflective portions, each cut-out portion adapted to permit transmission therethrough of a portion of the output beam of a discrete one of the bars in the array.

20. The apparatus of claim 19, wherein the cut-out portions include opposing inside surfaces, each of which inside surfaces is oriented approximately parallel to the path of travel of the portion of the output beam transmitted therethrough.

21. The apparatus of claim 20, wherein the opposing inside surfaces of each cut-out portion include an anti-reflective coating.